

# SESSION 3: POLARIS REVIEW

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**PAME**

Protection of the Arctic Marine Environment



**PAME POLARIS  
DATA COLLECTION  
AND EVALUATION  
PROJECT**  
*DRUMMOND FRASER*

- POLARIS Project (CAN/IMO) – Approved by PAME November 2024.
- **KEY OBJECTIVES:**
  - To establish a Correspondence Group with relevant experts to identify what information is necessary to conduct a review of POLARIS (IMO MSC.1/Circ.1519);
  - To collect this information from operators with the assistance of Arctic States and Observer State administrations;
  - To evaluate the information collected to understand the effectiveness of POLARIS as an operational tool;
  - To identify any needs for refinement;
  - To complete a Summary Report.
- First Correspondence Group meeting occurred January 15 2025.

# ORIGINS OF POLARIS

How to include something meaningful on the operational certificate that can be used by Administrations and Operators to evaluate the limitations for the ship operating in ice?

- Limiting Level Ice Thickness? – one condition!
- Polar Class / Ice Class Rule Descriptions? – usually “nominal”!
- Reference a system? – a few national systems, complicated wording [for the certificate]?

Category	Ice Class	Upper Limit of Ice Thickness (cm)									
		10	15	30	50	70	120	200	300		
		New	Young/ Grey	Young/ Grey White	Thin/ First Stage	Thin/ Second Stage	Medium	Thick	Old/ up to 3m	Old/ > 3m	
A <sup>1</sup>	PC1	Green									
	PC2	Green									
	PC3	Green									
	PC4	Green									
	PC5	Green									
B <sup>1</sup>	PC6	Green									
	PC7	Green									
C <sup>2</sup>	1B	Green									
	1C	Green									
	II	Red									
	O/W	Red									

Notes  
 1 - Equivalencies can be used as provided for in Part I-B  
 2 - Baltic ice classes shown can be substituted using the equivalencies provided in HELCOM 25/7

IACS
Context

**MSC93: Agreement that limitations for operating in ice to be included on the Certificate**

**MSC93 proposed initial guidance on limitations for operating in ice: MSC93/WP.7/Add1, Para 10:**

in order to include the operational limitations in ice in the certificate, the group included a guidance in square brackets in part I-B of the draft Code, which will need to be further developed in conjunction with section 1.5 of part I-A, before the adoption of the Code (see part I-B, Additional guidance to chapter 1, Limiting ice capabilities for the Polar Ship Certificate). **In this context, the group noted that the observer from IACS stated that IACS would be willing to undertake further work on the guidance with the intention to submit a document to MSC 94. The group also noted that some interested delegations would cooperate with IACS on this necessary and urgent work.**



IACS
Participants and structure of informal group

Develop Technical Content

↓

Develop Proposal

↓

Review and Validate

}

Technical Group

Informal CG

**Technical Group:** IACS, Canada, Denmark, Finland, Russia, Sweden

**Informal Correspondence Group:** email group consisting of volunteer members from MSC93 WG

Safer and Cleaner Shipping

# POLARIS DEVELOPMENT

MSC.93 output

Category	Ice Class	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	485	490	495	500
A'	PC1	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	485	490	495	500

May 2014

MSC93 Limitations Concept / Table

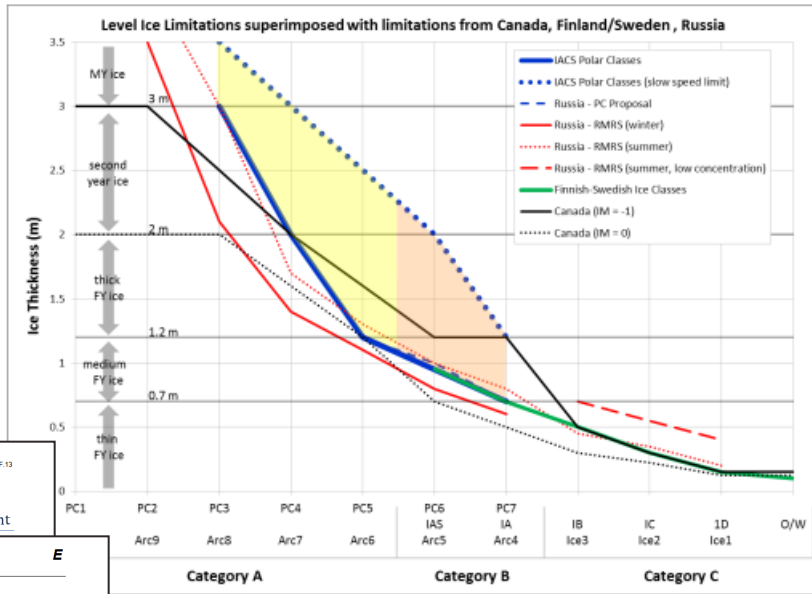
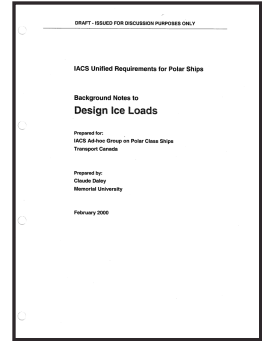
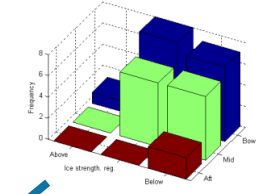


Table of Ice Multipliers for each Ship Category

Ice Code	Ice Type	Type B	Type D	Type C	Type B	Type A	CAC 3	CAC 2	CAC 1
7 or 8	Old Multi-Year Ice (MY)	-4	-4	-4	-4	-3	-1	-1	-1
8	Second Year Ice (SY)	-4	-4	-4	-3	-2	-1	-1	-1
6 or 4	Thick First-Year Ice (TFY) > 100 cm	-3	-3	-3	-2	-1	1	2	2
10	Medium First-Year Ice (MFY) 10-100 cm	-2	-2	-2	-1	1	2	2	2
7	Thin First-Year Ice (FY)	-1	-1	-1	1	2	2	2	2
9	Thin First-Year Ice - 2nd Stage	-1	-1	1	1	2	2	2	2
8	Thin First-Year Ice - 1st Stage	-1	-1	1	1	2	2	2	2
3 or 5	Grey/White Ice (GW) 15-30 cm	-1	1	1	1	2	2	2	2
4	Grey Ice (G)	1	2	2	2	2	2	2	2
2	Nilas Ice (NI)	2	2	2	2	2	2	2	2
1	New Ice (N)	-	-	-	-	-	-	-	-
1A	Brash Ice Fragments - 2 m across	-	-	-	-	-	-	-	-
1A	Brash Water	-	-	-	-	-	-	-	-
1A	Open Water	-	-	-	-	-	-	-	-

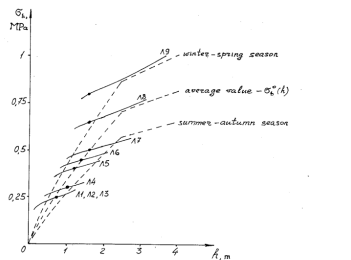
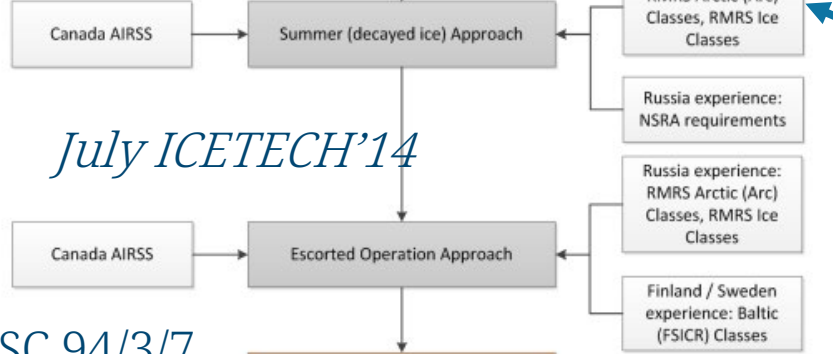
Consolidated Level ice (100% concentration) limit

Level ice (100% concentration) limit with adjusted ice type terminology

Partial Ice Concentration Approach

Summer (decayed ice) Approach

Escorted Operation Approach



Polar Operational Limitations Assessment Risk Indexing System (POLARIS) Background to Development

ANNEX MSC.94/INF.13

IMO MARITIME SAFETY COMMITTEE 84th session Agenda Item 3

CONSIDERATION AND ADOPTION OF AMENDMENTS TO MANDATORY INSTRUMENTS

Technical background to POLARIS

OTC-29143-MS

Evaluating Risk and Determining Operational Limitations for Ships in Ice

J. Bond, ABS, R. Huxley, Alsea Arctic Technology Inc., A. Kankkonen, URS, J. Jankinen, L. Kuitila, Finnish Transport Safety Agency

The paper was prepared for presentation at the Arctic Technology Conference 2014 in Helsinki, Finland, 10-12 November 2014.

The paper was approved by the Maritime Safety Committee at its 84th session on 12 September 2014.

Executive summary: This paper presents a system (POLARIS) for determining operational limitations for ships operating in ice. The system is based on the operational limitations in ice set by the Polar Code and takes into account the specific characteristics of the ship and the ice conditions. The system is designed to be used by the ship's operator to determine the operational limitations for the ship in ice. The system is based on the operational limitations in ice set by the Polar Code and takes into account the specific characteristics of the ship and the ice conditions. The system is designed to be used by the ship's operator to determine the operational limitations for the ship in ice.

Introduction: The Polar Code Working Group, at MSC.93, expressed the need for limitations for operation in ice to be based on the Polar Code. The Working Group agreed that the operational limitations in ice should be based on the operational limitations in ice set by the Polar Code and take into account the specific characteristics of the ship and the ice conditions. The Working Group agreed that the operational limitations in ice should be based on the operational limitations in ice set by the Polar Code and take into account the specific characteristics of the ship and the ice conditions. The Working Group agreed that the operational limitations in ice should be based on the operational limitations in ice set by the Polar Code and take into account the specific characteristics of the ship and the ice conditions.

MSC 94/INF.13 Sept. 2014

IMO MARITIME SAFETY COMMITTEE 84th session Agenda Item 3

CONSIDERATION AND ADOPTION OF AMENDMENTS TO MANDATORY INSTRUMENTS

POLARIS - proposed system for determining operational limitations in ice

Submitted by the International Association of Classification Societies (IACS)

SUMMARY

Executive summary: This document presents a system (POLARIS) for determining operational limitations for operation in ice, which is proposed as an update to the existing draft text in part 1-B of the Polar Code.

Strategic direction: 5.2

High-level action: 5.2.1

Planned output: 5.2.1.15

Action to be taken: Paragraph 9

Related documents: MSC.93WP.7/Add.1, MSC.94/INF.13 and MSC.94/INF.13

Introduction

1. The Polar Code Working Group, at MSC.93, expressed the need for limitations for operation in ice to be based on the Polar Code. The Working Group agreed that the operational limitations in ice should be based on the operational limitations in ice set by the Polar Code and take into account the specific characteristics of the ship and the ice conditions. The Working Group agreed that the operational limitations in ice should be based on the operational limitations in ice set by the Polar Code and take into account the specific characteristics of the ship and the ice conditions. The Working Group agreed that the operational limitations in ice should be based on the operational limitations in ice set by the Polar Code and take into account the specific characteristics of the ship and the ice conditions.

Polar Operational Limit Assessment Risk Indexing System - POLARIS

2. The proposed Polar Operational Limit Assessment Risk Indexing System (POLARIS) builds on the existing operational limitations in part 1-B of the draft Polar Code by recognizing that limitations need to be related to the ice class assigned to the ship and the ice conditions in which the ship is intended to operate.

MSC.94/3/7

PAME

Protection of the Arctic Marine Environment

Report of Correspondence Group POLARIS (MSC 96)

MSC.1 Circ.1519 June 2016

IMO MARITIME SAFETY COMMITTEE 84th session Agenda Item 3

CONSIDERATION AND ADOPTION OF AMENDMENTS TO MANDATORY INSTRUMENTS

GUIDANCE ON METHODOLOGIES FOR ASSESSING OPERATIONAL CAPABILITIES AND LIMITATIONS IN ICE

1. The Maritime Safety Committee, at its 84th session on 12 September 2014, adopted the resolution MSC.94/3/7 and the corresponding amendments to the Polar Code, which will be implemented by the Maritime Safety Committee through the development of methodologies for the assessment of operational capabilities and limitations in ice, which will be reflected in the Polar Code. The Committee also agreed that the assessment should be based on the operational capabilities and limitations in ice.

2. The Polar Code also requires that information on ship-specific capabilities and limitations in ice be provided to the flag State and the port State. The Committee agreed that the information should be provided in a format that is consistent with the requirements of the Polar Code.

3. The assessment guidance addresses the development of methodologies for the assessment of operational capabilities and limitations in ice, which will be reflected in the Polar Code. The Committee agreed that the assessment should be based on the operational capabilities and limitations in ice.

4. The assessment guidance is intended to provide guidance to the flag State and the port State on how to assess the operational capabilities and limitations in ice of ships operating in ice. The Committee agreed that the assessment should be based on the operational capabilities and limitations in ice.

5. In the resolution, Member States and international organizations are invited to report on the work done in the area of the assessment of operational capabilities and limitations in ice to the Maritime Safety Committee through the agenda item "Any other business".

6. Member States are invited to report on the work done in the area of the assessment of operational capabilities and limitations in ice to the Maritime Safety Committee through the agenda item "Any other business".



# POLARIS: PERSPECTIVES ON UPDATES

*ROB HINDLEY*

- Glacial Ice – Not covered at all in POLARIS, recognized as an issue during development, but no simple regulation to borrow from
- Ice Concentration – Formula basically gives linear risk with increased (total) ice concentration, it is most probably non linear, especially at low concentrations
- Icebreaker Escort – +10 to the RIO was a simplification, could be supported more and approach to considering brash / icebreaker track clarified
- Decayed Ice – When to apply, and where it applies. Especially for the Antarctic. RIVs are only adjusted for later stages of FYice...but no adjustments for MY
- Slow Speed – Nominal 3 and 5 knot speeds pulled from Polar Class rules

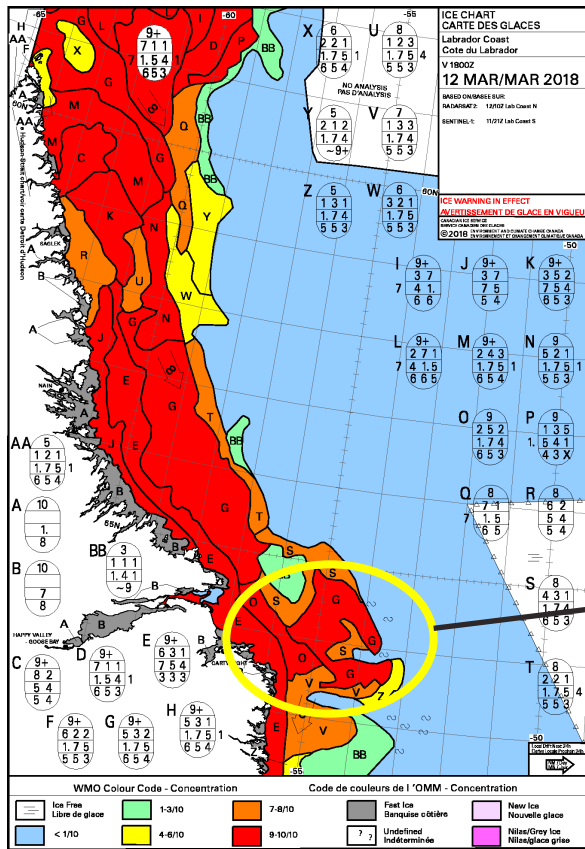
# How ABS Uses POLARIS

- Beyond POLARIS being listed on a Polar Ship Certificate
- Answer the following questions:
  - What Ice Class is needed to go where and when or conversely what is the window of opportunity for a given route / destination for an existing ship?
    - ABS POLARIS maps for specific areas for each week of a year
  - Which ships are using the NWP and do voyage ice conditions match expectation from POLARIS?
    - Gives insights into how well POLARIS is working
  - What is the impact on shipping as ice conditions change?
    - Most recent work indicates that change / impact is significant
    - Leads to speculation regarding NWP broad viability

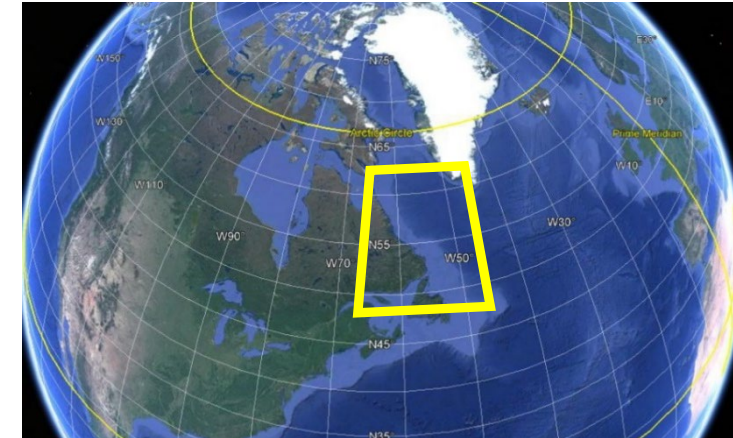
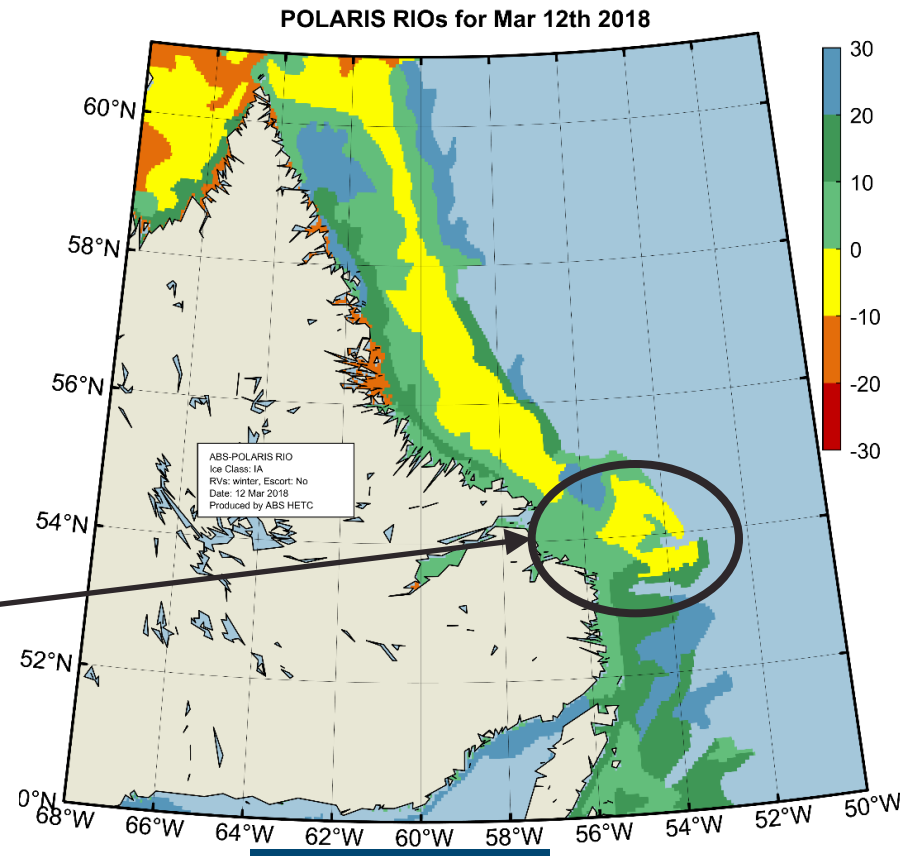
# ABS POLARIS

- Expands IMO POLARIS methodology from a single Risk Index Outcome value to compilation plot
- Uses published, publicly available ice charts (Arctic and Antarctic)

Canadian Ice Service

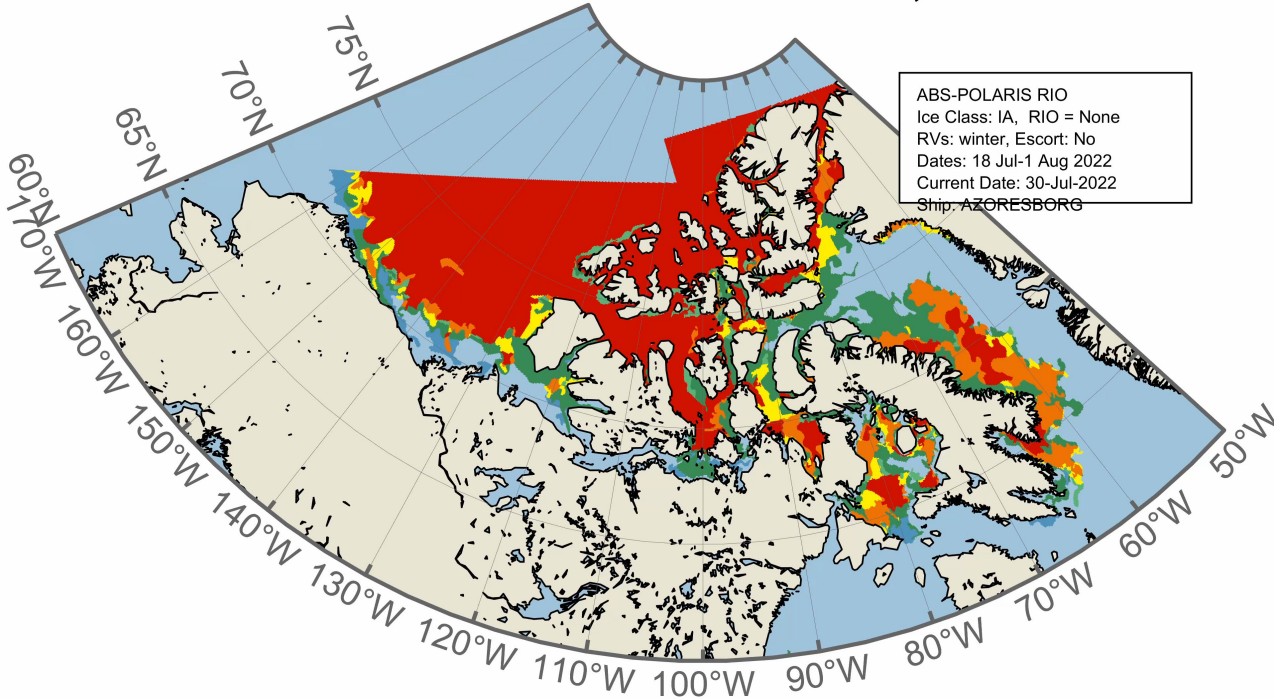


ABS-POLARIS

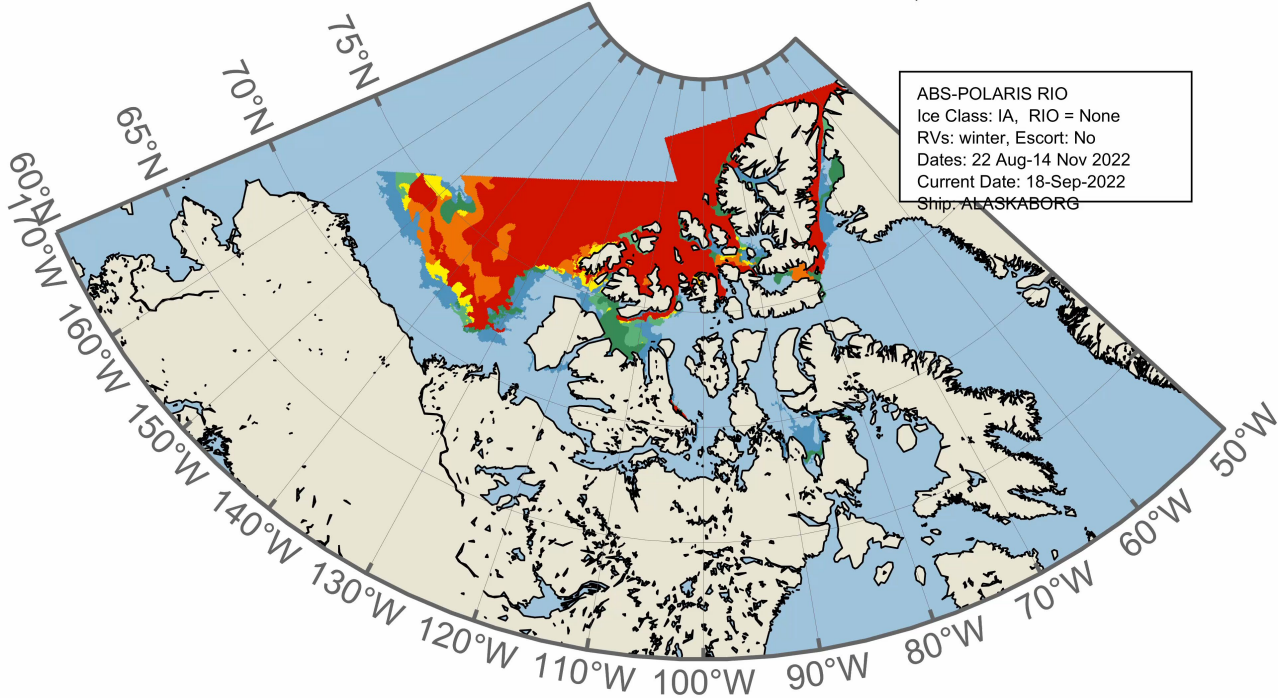


# ABS POLARIS: 2022 ROYAL WAGENBORG

### ABS-POLARIS RIOs for AZORES BORG, 2022



### ABS-POLARIS RIOs for ALASKA BORG, 2022





# IMPACT ON NWP DUE TO CHANGING ICE CONDITIONS

- Analyzed NWP Route 3 (broken into segments) RIO values for a PC7 during 2<sup>nd</sup> week of Oct
- Historically most challenging areas along Route 3 have been north of Baffin Island through Peel Sound, Franklin Strait and Victoria Strait (our segments 7 to 10)
- Ice conditions in these critical segments are showing a move from significantly negative RIOs to significantly positive RIOs, with variability apparent in the data
- Food for thought!

Segment #	POLARIS RIO Values										
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
1	30	30	30	30	30	30	30	30	30	30	
2	30	30	30	19	21	30	30	30	30	30	
3	30	30	18	6	21	30	30	30	-8	30	
4	18	20	-20	-22	15	25	22	-7	-8	21	
5	-14	20	-25	-4	-10	5	-4	-13	30	23	
6	-14	20	-20	7	-10	5	-4	-13	30	23	
7	-14	20	-20	6	-10	5	20	-13	30	23	
8	-25	23	30	4	5	22	20	18	30	28	
9	-25	-25	21	11	5	13	11	15	30	30	
10	-25	-25	30	-14	-20	13	11	30	30	30	
11	-25	30	30	18	14	30	30	30	30	30	
12	-25	30	30	15	20	30	30	30	30	30	
13	-9	28	30	21	20	30	30	30	30	30	
14	3	30	30	21	20	30	30	30	30	30	
15	30	30	30	30	30	30	30	30	30	30	
16	30	30	30	30	30	30	30	30	30	30	
17	30	30	30	30	27	30	30	30	30	30	
18	30	30	30	30	20	30	30	30	30	30	
19	30	30	30	30	-20	30	30	30	30	30	
20	30	18	30	30	-30	30	30	21	21	30	
21	30	24	30	30	14	30	-13	21	30	30	
22	30	22	30	30	15	30	-13	10	28	30	
23	30	23	30	30	30	30	30	30	30	30	
24	30	30	30	30	30	30	30	30	30	30	
25	30	30	30	30	30	30	30	30	30	30	
26	30	30	30	30	30	30	30	30	30	30	
27	30	30	30	30	30	30	30	30	30	30	

# POLARIS IMPLEMENTATION

MORTEN MEJLÆNDER-  
LARSEN

- DNV has issued more than 400 Polar Ship Certificates.
- Experience and feedback related to use of POLARIS is limited
- The user experience from operators are:
  - ✓ Used for planning and documentation, - when and where to operate
  - ✓ Requires basic knowledge about:
    - ✓ Ice in general
    - ✓ Limitations in the available data
    - ✓ The actual vessels limitations regarding speed, concentration, hull strength, ability to transit and size dependent factors.
- Before entering ice: - how to avoid ice
- When in ice: - how to find easiest way through
- No systematic feedback is currently available

# POLARIS IMPLEMENTATION

*MORTEN MEJLÆNDER-  
LARSEN*

Some questions to be addressed:

- Common understanding of ice concentration - low ice concentration is not the same as low risk
- Understanding the impact of vessel speed
- Need for better and standardization of ice information
- Training

The most important risk reducing measure is the knowledge transfer from ice captains and own experience at the bridge

# Arctic Shipping Pollution Prevention Regulations - North of 60° latitude

## ARCTIC ICE REGIME SHIPPING SYSTEM (AIRSS)

IVANA KUBAT

- Arctic Ice Regime Shipping S

$$IN = [C_a \times IM_a] + [C_b \times IM_b] + \dots$$

where

IN = Ice Numeral

$C_a$  = Concentration in tenths of ice type “a”

$IM_a$  = Ice Multiplier for ice type “a” and Ship Category (from the Table)

- IN positive = go
- IN negative = don't go

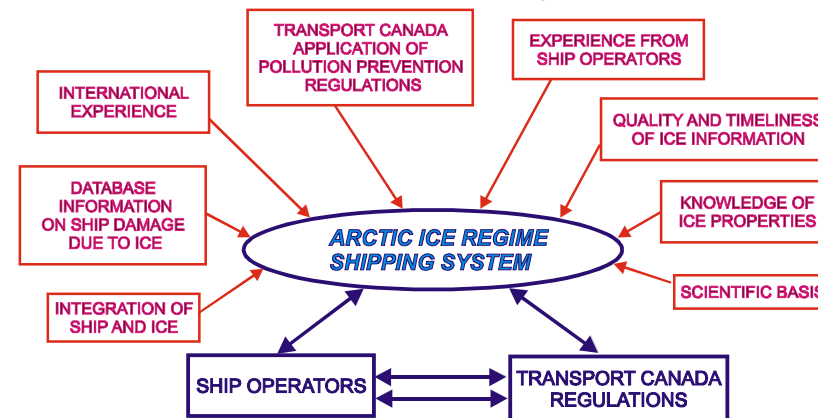
Table Of Ice Multipliers By Ship Category

AIS / WMO Ice Codes	Ice Types	Ice Multipliers for each Ship Category						
		Type E	Type D	Type C	Type B	Type A	CAC 4	CAC 3
7• or 9•	Old / Multi-Year Ice..... (MY)	-4	-4	-4	-4	-4	-3	-1
8•	Second Year Ice..... (SY)	-4	-4	-4	-4	-3	-2	1
6 or 4•	Thick First Year Ice..... (TFY) > 120 cm	-3	-3	-3	-2	-1	1	2
1•	Medium First Year Ice..... (MFY) 70-120 cm	-2	-2	-2	-1	1	2	2
7	Thin First Year Ice..... (FY) 30-70 cm	-1	-1	-1	1	2	2	2
9	Thin First Year Ice - 2nd Stage 50-70 cm	-1	-1	1	1	2	2	2
8	Thin First Year Ice - 1st Stage 30-50 cm	-1	-1	1	1	2	2	2
3 or 5	Grey-White Ice..... (GW) 15-30 cm	-1	1	1	1	2	2	2
4	Grey Ice..... (G) 10-15 cm	1	2	2	2	2	2	2
2	Nilas, Ice Rind < 10 cm	2	2	2	2	2	2	2
1	New Ice..... (N) < 10 cm	“	“	“	“	“	“	“
	Brush (ice fragments < 2 m across)	“	“	“	“	“	“	“
⇒ Δ	Bergy Water	“	“	“	“	“	“	“
⇒ ⇒ ⇒ ⇒	Open Water	“	“	“	“	“	“	“

Notes: Decayed Ice: For the following ice types: MY, SY, TFY, and MFY that are 'decayed', add 1 to the Ice Multiplier.  
Ridged Ice: For floes of ice that are over 3/10ths 'Ridged' and in an overall concentration that is greater than 6/10ths, subtract 1 from the Ice Multiplier.

- Context Diagram for the scientific basis for the Ice Regime System

The main factors driving the work





# Canadian Ice Regime System Database\*

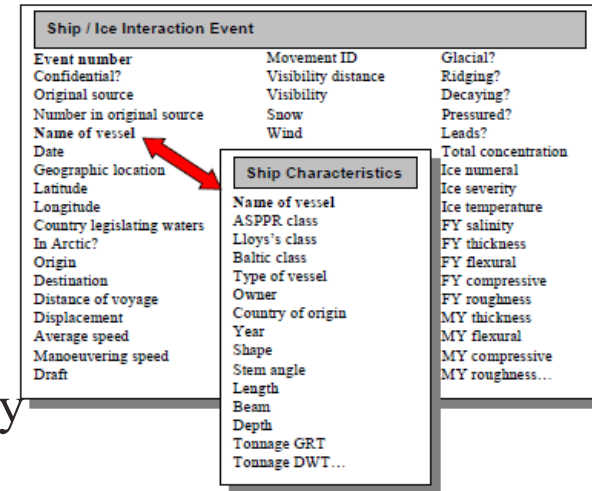
## ARCTIC ICE REGIME SHIPPING SYSTEM (AIRSS)

IVANA KUBAT

- NRC developed a comprehensive Database with information on a large number of different ships and ship classes. The information included both damage and non-damage Events. The event is described as ship transit through a known ice regime and includes all relevant information about the transit, including the vessel characteristics, route, climate, ice conditions and resulting damage (or no damage). The database contained almost 2000 events, with about 250 damage events.

- Source of Information

- NORDREG After Action Reports
- Ship trial reports
- Norland and AKAC damage reports
- CIS (Canadian Ice Service) Ice Charts
- Transit Reports from the shipping industry
- Transportation Safety Board Reports
- ISS Field Books (CIS Ice Service Specialists) and Canadian Coast Guard Commanding Officers
- Information was reviewed and consulted with experienced Captains and operators; systematic feedback



# ARCTIC ICE REGIME SHIPPING SYSTEM (AIRSS)

*IVANA KUBAT*

## Analysis (examples)

- Damage events in ice regime with positive IN
- Non-damage events in ice regime with negative IN
- Observed versus Predicted ice conditions
- Bonus to experienced masters, operators and ice navigators
- Presence of Multi-year ice in the ice regime
- Summer conditions, ship under escort, visibility
- Looked at deficiencies of the system
- Pictorial Guide (TP 14044E)
- Understanding and Identifying Old Ice in Summer (CHC-TR-055)

## Collaboration

- Canadian Shipping Industry (Fednav, NEAS, Desgagné, PetroNav, Woodward)
- Surveys and meetings with CCG Commanding Officers
- CIS ISS pre and post-Arctic meetings
- Many Workshops (Government, Shipping Industry, Oil&Gas Industry reps)
- International Meetings and workshops
- SAFEICE (Increasing the Safety of Icebound Shipping) Project – Canada, Finland, Sweden, Germany, Russia, Estonia, Japan,

# DISCUSSION